1.8.30. METHOD OF RECOGNITION OF ARISING DEFECTS OF THE MACHINES, BASED ON STUDYING OF FEATURES OF THEIR NATURAL FREQUENCIES

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Introduction. Work is devoted to development and improvement of the power equipment vibration diagnostic control methods [1 – 3].

The method of recognition of arising defects of machines based is offered on: deep preliminary studying of object of diagnosing, construction mechanical (electric-, hydraulic-, mechanical) and mathematical models of object, theoretical calculation of its spectral portrait. Practical examples are given.

The basic results. Today the main scientific direction of nondestructive testing and diagnostics (NDT&D) – it is development of new physical, physical and chemical methods, ways and devices of diagnosing of parameters, development of means of instrument making and automation, processing of the information with a problem of definition of a residual resource of potentially dangerous objects and risk of their operation [3].

Thus vibration diagnostic control of arising defects is very important direction in diagnostics of the equipment as detection of damages at an early stage of their development provides prevention of sudden refusals, transition to operation and maintenance service of the equipment on an actual condition, data acquisition for forecasting a residual service life.

The majority of methods of diagnosing of arising defects of the equipment have in the basis following diagnostic model:

– development of defect causes in a vibrating signal growth of number and amplitude of short-term emissions of a signal of type of shock impulses;

– shock impulses modulate oscillations on forced and natural frequencies of the equipment.

The problem consists in finding an optimum method of processing of a signal for allocation of the information on development of the damage, reducing to a minimum influence of handicapes and allowing unequivocally to correlate the received characteristic of a signal with a kind of defect.

For this purpose the vibration diagnostic control method of the power equipment over parameters of sensitivity of units to influences raising vibration is offered. The given method provides calculation of spectral portraits of objects of diagnosing, including, by means of system of computer algebra of kinematic and dynamic researches of machines and mechanisms (SCA KIDYM) [1, 2].

The block diagram of traditional system vibration diagnostics is added by the block of calculation vibrating information. With a view of overcoming difficulties by definition of a place and a kind of damages, simplifications of diagnostic procedure the diagnostic model, allowing to estimate by means of power parities a congenital rating of elements of object to development of defects is offered.

Any equipment possesses congenital dynamic characteristics and the structure, depending from design features. Thus the level of sensitivity of units of the equipment to origin and development of damages is defined by power parities on corresponding natural frequencies of oscillations.

As criteria of the most probable occurrence of defects it is offered to use power-intensive levels (power modes) units on corresponding natural frequencies of oscillations

of dynamic model of object of diagnosing. The more relative share of kinetic (potential) energy of an inertial (elastic) element on given natural mode of oscillations, the more sensitively the given element to the damages causing change of parameters of oscillations.

Thus, occurrence of defect judge on occurrence of amplitudes of oscillations power-intensive units of the equipment on natural frequencies of object of diagnosing. Development of defect judge on a difference of amplitudes of oscillations power-intensive units of the equipment on natural frequencies of object of the diagnosing, measured in various time (on direct spectra and-or spectra bending around a signal).

Also in practical problems test vibration diagnostic control of the equipment over the diagnostic information it is expedient to use parameters of power modes of oscillations.

Efficiency of the analysis of free oscillations considerably depends on the form and a point of the appendix of excitation to object. At the analysis of free oscillations of the mode chosen by the diagnostician the best place and a direction of excitation is the point in a zone of a power-intensive element of the given power mode of oscillations of system and a direction in which these oscillations will have a maximum.

Comparing usual and power modes of oscillations it is possible to make the important conclusion, that antinodes and nodes of usual modes of free oscillations not always are high-sensitivity places accordingly to excitation of oscillations and origin of cracks.

Discussion of results. The developed method deepens process of diagnosing of objects by construction of aprioristic basis of system of technical diagnostics (calculation of a spectral portrait) and can be applied together with a method of the analysis bending around a vibrating signal on resonant frequencies of the mechanism, dimensionless "S-discriminants".

The method of recognition of arising defects of the machines, based on studying of features of their natural frequencies, provides: forecasting of origin of defects on structure of objects; the individual control of a technical condition of the power equipment over comparison spectral "portraits" in a range of natural frequencies of oscillations; reduction of time of inspection of the equipment at its operation on a condition; detection of operational damages of units of the power equipment at an early stage, the control of development of malfunctions of the power equipment; emergency protection of the power equipment.

Reliability of the offered method is confirmed by conformity of the basic scientific positions and conclusions with experimental results at diagnosing industrial tractors, a diesel engine-generators and ship power installations on the basis of diesel engines of family 16.5/18.5, centrifugal pumps with the asynchronous electric drive capacity of 5,000 kW, centrifugal pumps for an oil recovery with the asynchronous electric drive and other objects.

References:

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